

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A method of punching a through hole at a metal board, comprising steps of:

providing an upper die, a first lower die, a second lower die and a third lower die;

forming an unpenetrating hole at an upper face of the metal board with the upper die and the first lower die, so that a protrusion is formed on a lower face of the metal board at a portion corresponding to the unpenetrating hole;

forming a flat portion on the protrusion with the second lower die without using the first lower die; and

punching the unpenetrating hole with the upper die while supporting the flat portion with the third lower die to form the through hole.

2. (original): The punching method as set forth in claim 1, wherein a bottom of the unpenetrating hole is supported by the upper die when the flat portion is formed.

3. (original): The punching method as set forth in claim 1, wherein the upper face of the metal board is supported by the upper die when the flat portion is formed.

4. (original): The punching method as set forth in claim 1, wherein the upper die comprises a first upper die which forms the unpenetrating hole and a second upper die which forms the through hole.

5. (original): The punching method as set forth in claim 1, wherein a draft is provided on the upper die.

6. (previously presented): The punching method as set forth in claim 1, wherein the second lower die is configured such that the flat portion is annularly formed.

7. (canceled).

8. (previously presented): The punching method as set forth in claim 1, wherein the upper die, the first lower die, the second lower die and the third lower die are configured such that a plurality of through holes are simultaneously punched.

9. (original): The punching method as set forth in claim 8, wherein the through holes are arranged with an interval of 0.3mm or less.

10. (original): The punching method as set forth in claim 1, wherein a maximum width dimension of the through hole is 0.2mm or less.

11. (original): The punching method as set forth in claim 1, wherein a ratio of a penetrating length of the through hole with respect to a maximum width dimension of the through hole is 0.5 or more.

12. (original): The punching method as set forth in claim 1, wherein the through hole is formed at a portion of the metal board which has been subjected to a plastic working.

13. (original): The punching method as set forth in claim 1, further comprising a step of removing burrs formed on the metal board.

14. (original): The punching method as set forth in claim 1, wherein the through hole has a rectangular cross section.

15. (original): The punching method as set forth in claim 1, wherein the through hole has a circular cross section.

16. (original): The punching method as set forth in claim 1, wherein the metal board is comprised of nickel.

17. (previously presented): A method of manufacturing a liquid ejection head, comprising steps of:

providing a metal board;

subjecting the metal board to a plastic working to form a recess on a first face of the metal board;

providing an upper die, a first lower die, a second lower die and a third lower die;

forming an unpenetrating hole at the first face of the metal board with the upper die and the first lower die, so that a protrusion is formed on a second face of the metal board at a portion corresponding to the unpenetrating hole, the second face being opposite to the first face;

forming a flat portion on the protrusion with the second lower die;

punching the unpenetrating hole with the upper die while supporting the flat portion with the third lower die to form the through hole;

attaching a metallic nozzle plate formed with a nozzle, onto the second face of the metal board, such that the nozzle is communicated with the through hole; and

attaching a metallic sealing plate formed with a liquid supply hole, onto the first face of the metal board so as to seal the recess, so that pressure generated in liquid supplied to the recess via the liquid supply hole ejects a liquid droplet from the nozzle via the through hole.

18. (currently amended): A punching apparatus, comprising:

an upper die and a first lower die, operable to form an unpenetrating hole at an upper face of a metal board so that a protrusion is formed on a lower face of the metal board at a portion corresponding to the unpenetrating hole;

a second lower die, operable to form a flat portion on the protrusion without the first lower die; and

a third lower die, operable to support the flat portion when the upper die punches the unpenetrating hole to form a through hole at the metal board.

19. (original): The punching apparatus as set forth in claim 18, wherein the upper die supports a bottom of the unpenetrating hole when the flat portion is formed.

20. (original): The punching apparatus as set forth in claim 18, wherein the upper die supports the upper face of the metal board when the flat portion is formed.

21. (original): The punching apparatus as set forth in claim 18, wherein the upper die comprises a first upper die which forms the unpenetrating hole and a second upper die which forms the through hole.

22. (original): The punching apparatus as set forth in claim 21, wherein a width of the first upper die is greater than a width of the second upper die.

23. (original): The punching apparatus as set forth in claim 21, wherein the upper die further comprises a third upper die which supports a bottom of the unpenetrating hole when the flat portion is formed.

24. (original): The punching apparatus as set forth in claim 23, wherein a width of the third upper die is smaller than a width of the first upper die.

25. (original): The punching apparatus as set forth in claim 18, wherein a draft is provided on the upper die.

26. (previously presented): The punching apparatus as set forth in claim 18, wherein the second lower die is configured such that the flat portion is formed annularly.

27. (previously presented): The punching apparatus as set forth in claim 18, wherein:
the second lower die is formed with a first working hole which defines the flat portion,
and the third lower die is formed with a second working hole which defines a portion for
supporting the flat portion; and

a size of the second working hole is greater than the first working hole.

28. (previously presented): The punching apparatus as set forth in claim 27, wherein:
the first lower die is formed with a third working hole which defines a portion at which
the protrusion is formed; and

a size of the third working hole is greater than the size of the second working hole.

29. (previously presented): The punching apparatus as set forth in claim 18, wherein the upper die, the first lower die, the second lower die and the third lower die are configured such that a plurality of through holes are simultaneously punched.

30. (previously presented): The punching method as set forth in claim 1, wherein different dies are used as the second lower die and the third lower die.

31. (previously presented): The punching method as set forth in claim 1, wherein an identical die is used as the second lower die and the third lower die.

32. (previously presented): The punching apparatus as set forth in claim 18, wherein an identical die is used as the second lower die and the third lower die.

33. (previously presented): A method of manufacturing a liquid ejection head, comprising steps of:

providing a metal board;

subjecting the metal board to a plastic working to form a recess on a first face of the metal board;

punching a through hole communicating the recess and a second face of the metal board;

attaching a metallic nozzle plate formed with a nozzle, onto the second face of the metal board, such that the nozzle is communicated with the through hole; and

attaching a metallic sealing plate formed with a liquid supply hole, onto the first face of the metal board so as to seal the recess, so that pressure generated in liquid supplied to the recess via the liquid supply hole ejects a liquid droplet from the nozzle via the through hole.